CLAIMS

We claim:

1. A hydrogen storage alloy having a $CaCu_5$ crystal structure, said alloy comprising a lanthanide element, Ni and Co, the concentration of Co not exceeding 9 at.%, said alloy having a half-cell capacity of at least 100 mAh/g and a maximum concentration difference of less than 0.25 wt.% absorbed hydrogen.

2. The alloy of claim 1, wherein said alloy comprises a mischmetal, said mischmetal including said lanthanide element.

3. The alloy of claim 1, wherein said alloy further comprises a cycle life enhancement element, said cycle life enhancement element being selected from the group consisting of Zr, Sc, Ca, Mg, Ti, V, Cr and Si.

4. The alloy of claim 3, wherein said cycle life enhancement element is Zr or Si.

5. The alloy of claim 3, wherein the concentration of said cycle life enhancement element is between 0.2 and 1.7 at.%.

6. The alloy of claim 3, wherein the concentration of said cycle life enhancement element is between 0.2 and 1.1 at.%.

7. The alloy of claim 3, wherein the concentration of said cycle life enhancement element is between 0.5 and 1.1 at.%.

8. The alloy of claim 3, wherein said alloy further comprises Cu.

9. The alloy of claim 8, wherein the concentration of Cu is at least 1.5 at.%.

10. The alloy of claim 8, wherein the concentration of Cu is at least 3 at.%.

11. The alloy of claim 1, wherein said alloy further comprises Mn.

12. The alloy of claim 1, wherein said alloy further comprises Al.

13. The alloy of claim 1, wherein the concentration of Co does not exceed 7 at.%.

14. The alloy of claim 1, wherein the concentration of Co does not exceed 5 at.%.

15. The alloy of claim 1, wherein the concentration of Co does not exceed 3 at. %.

16. The alloy of claim 1, wherein said alloy has a maximum concentration difference of less than 0.20 wt.% absorbed hydrogen.

17. The alloy of claim 1, wherein said alloy has a maximum concentration difference of less than 0.15 wt.% absorbed hydrogen.

18. The alloy of claim 1, wherein said alloy has a maximum concentration difference of less than 0.10 wt.% absorbed hydrogen.

19. The alloy of claim 1, wherein said alloy has a half-cell capacity of at least 200 mAh/g.

20. The alloy of claim 1, wherein said alloy has a half-cell capacity of at least 300 mAh/g.

21. The alloy of claim 1, wherein said alloy has a magnetic susceptibility of at least 250 memu/g.

22. The alloy of claim 1, wherein said alloy has a magnetic susceptibility of at least 400 memu/g.

23. The alloy of claim 1, wherein said alloy has a magnetic susceptibility of at least 525 memu/g.

24. A hydrogen storage alloy having a $CaCu_5$ crystal structure, said alloy comprising a lanthanide element, Ni, Cu and Co, said alloy having a Cu concentration of at least 1.5 at. %, said alloy having a concentration of Co not exceeding 9 at.%, said alloy having a half-cell capacity of at least 100 mAh/g and a maximum concentration difference of less than 0.25 wt.% absorbed hydrogen.

25. The alloy of claim 24, wherein said alloy further comprises Zr or Si.

26. The alloy of claim 24, wherein said alloy has a half-cell capacity of at least 200 mAh/g.

27. The alloy of claim 24, wherein said alloy has a half-cell capacity of at least 300 mAh/g.

28. A hydrogen storage alloy having a $CaCu_5$ crystal structure, said alloy comprising a lanthanide element, Ni and Co, the concentration of Co not exceeding 9 at.%, said alloy having a maximum concentration difference of less than 0.25 wt.% absorbed hydrogen and a magnetic susceptibility of at least 250 memu/g.

29. The alloy of claim 28, wherein said magnetic susceptibility is at least 400 memu/g.

30. The alloy of claim 28, wherein said magnetic susceptibility is at least 525 memu/g.

31. The alloy of claim 28, wherein said alloy further comprises Cu.

32. The alloy of claim 31, wherein said alloy further comprises Zr or Si.

33. A hydrogen storage alloy having a bulk region and an interface region, said interface region comprising catalytic metallic particles supported by a support matrix and voids, said catalytic metallic particles having diameters of less than about 100 Å, said catalytic metallic particles and said voids being distributed throughout said interface region, the volume fraction of said voids in said interface region being greater than 5%, said alloy having a half-cell capacity of at least 100 mAh/g and a maximum concentration difference of less than 0.25 wt.% absorbed hydrogen.

34. The hydrogen storage alloy of claim 33, wherein said alloy comprises La, Ni, Co, and Cu.

35. The hydrogen storage alloy of claim 34, wherein said alloy further comprises Zr or Si.

36. The hydrogen storage alloy of claim 33, wherein said interface region includes an oxygen concentration of at least 10%.

37. The hydrogen storage alloy of claim 33, wherein said catalytic metallic particles comprise nickel.

38. The hydrogen storage alloy of claim 33, wherein said catalytic metallic particles have diameters of less than 50 Å.

39. The hydrogen storage alloy of claim 33, wherein the volume fraction of said catalytic metallic particles in said interface region is greater than 30%.

40. The hydrogen storage alloy of claim 33, wherein the volume fraction of said catalytic metallic particles in said interface region is greater than 50%.

41. The hydrogen storage alloy of claim 33, wherein said catalytic metallic particles vary in proximity from 50 – 100 Å in said interface region.

42. The hydrogen storage alloy of claim 33, wherein said volume fraction of said voids in said interface region is greater than 10%.

43. The hydrogen storage alloy of claim 33, wherein said volume fraction of said voids in said interface region is greater than 20%.

44. The hydrogen storage alloy of claim 33, wherein said voids are channels.

45. The hydrogen storage alloy of claim 44, wherein said channels have a cross-sectional dimension of 10 – 20 Å.

46. The hydrogen storage alloy of claim 44, wherein said channels have a longitudinal dimension of greater than about 20 Å.

47. The hydrogen storage alloy of claim 33, wherein said bulk region has a $CaCu_5$ crystal structure.

48. The hydrogen storage alloy of claim 33, wherein said alloy has a half-cell capacity of at least 200 mAh/g.

49. The hydrogen storage alloy of claim 33, wherein said alloy has a half-cell capacity of at least 300 mAh/g.